REMARKS

Claims 1-7 are all the claims pending in the application.

Review and reconsideration on the merits are requested.

Prior art considered: U.S. Patent 5,954,898 McKague et al (McKague); JP 02030518, Hiyamizu et al (Hiyamizu); U.S. Patent 4,269,884 Della Vecchia et al (Della Vecchia). While the Examiner does not technically rely on Della Vecchia, quite clearly Della Vecchia is necessary to support the rejection.

While it is not entirely clear what the Examiner means by "Oral translation of JP 02030518", Applicants believe that the Examiner simply asked someone that can read Japanese what disclosure occurs in Hiyamizu.

The rejection as presented: claims 1-3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over McKague in view of Hiyamizu, English language Abstract of JP 02030518, and oral translation of JP 02030518 (sometimes JP '518 herein).

The above rejection is respectfully traversed.

The claim limitations

Claim 1 is limited by including the subject of claim 3 therein, thereby limiting to the subject matter of claims 1/3 and material equivalent thereto. In amended claim 1, "wherein in said first step (a) said plurality of sheets made of said fiber-reinforced composite are heated at a temperature of 20-100°C under 0.1 to 10 kg/cm^2, and cooled at a temperature of 10-30°C under 0.1 to 10 kg/cm^2; and" in said third step (c) said board is softened by heating at a temperature of 60-100°C for 10-90 minutes placed on a forming tool, and formed by cooling at a temperature of

0-50°C under a pressure of 0.1-10 kg/cm^2." finds support at page 4, lines 24-29, page 5, lines 4-9, page 5, lines 15-17 and page 5, lines 19-26 of the specification.

Further, to illustrate the simplicity of the method of the present application, dependent claim 4 is added, which requires the intermediate product is a T-shaped intermediate product composed of L-shaped board laminates and said flat board-shaped laminate each comprises only one flat board-shaped laminate." This recitation finds support at page 6, line 27, to page 9 of the specification.

Finally, original dependent claim 2 is essentially rewritten in independent form but with a 1-80% limit on the hardening degree as new claim 5.

In claims 5-7, the respective recitations "semi-hardened product having a hardening degree of 1 to 80%," "semi-hardened product having a hardening degree of 1 to 50%," and "semi-hardened product having a hardening degree of 5 to 20%" find support on page 4, lines 5-14 of the specification.

Applicants now address the rejection of claims 1-3 as obvious over McKague in view of Hiyamizu.

Since the features which support the patentability of the present claims are recited in amended claim 1, Applicants first discuss patentability only with respect to amended claim 1 in the following paragraphs.

If the Examiner will refer to amended claim 1, the Examiner will see that it is directed to a method for producing an intermediate product made of a fiber-reinforced composite composed of a reinforcing fiber impregnated with a thermosetting resin or a thermoplastic resin. The

process comprises three steps, as called for in claim 1, wherein in the final language in claim 1 steps (a) and (c) are precisely defined with respect to the conditions used.

Specifically, the present invention is limited to producing an intermediate product made of a fiber-reinforced composite as a semi-hardened product where reinforcing fibers have been impregnated with a thermoplastic resin or when impregnated with a thermosetting resin the thermosetting resin is only a semi-hardened product, i.e., is formed without curing. Examples of such intermediate products would be a stringer, a frame, etc., obtained by steps (a) to (c) per the present invention.

In direct contrast to the present invention, McKague discloses a method for fabricating a composite part from a plurality of composite layers, the part having a final shape, thickness and density, the method comprising five steps which relate to the simultaneous forming of multiple layers of composite materials into a desired shape or shapes and curing the materials to maintain the desired shape or shape(s) (underscoring added; see McKague claim 1, column 1, lines 18-21 and column 2, line 66 to column 3, line 21).

Further, in McKague, insofar as the processing of either flow 24 of Fig. 2 or flow 74 of Fig. 4 is concerned, partially cured laminate 34 or 82 is not provided automatically because of the use of oven 36 or 80 (different from a press roll per the present invention), an autoclave or other suitable means, in heating uncured or partially cured laminate 34 or 82 (see McKague Fig. 2 and column 6, lines 16-19; Fig. 4 and column 7, lines 37-52), though McKague may teach the use of automatic machinery to lay-up individual laminate layers 26 (see column 5, lines 36-44)

In this regard, the Examiner is respectfully requested to note that the pre-forms shown in Fig. 4 of McKague are merely intermediate parts (86, 86, 82) for forming a shaped product (90), quite different from a semi-hardened product as a final shaped product formed in accordance with the present invention which involves treatment of a laminated board (which would correspond to the debulked laminate 82 or right angle pre-forms 86 of McKague) under conditions for softening and cooling as defined in third step (c) of the present claims.

In the present Action at page 2, beginning at line 7 from the bottom of page 2 and continuing over to line 4 on page 3, the Examiner presents a rather detailed analysis of McKague. The Examiner's position can be characterized in shortened form as follows.

McKague teaches:

fiber reinforced composite pre-forms comprising reinforcing fibers impregnated with thermosetting resin; and

teaches a method for fabricating intermediate parts from the composite pre-forms comprising:

stacking a plurality of pre-forms;

laminating the stack under heat and pressure to form a composite laminate;

cooling the composite laminate to room temperature

cutting the laminate into a pattern;

heating the laminate to partially cure it; and

reshaping the laminate using a cool press forming tool.

Assuming *arguendo* that McKague teaches (a) stacking a plurality of preforms, laminating the stack under heat and pressure to form a composite laminate, and cooling the composite laminate to room temperature, and (c) heating the laminate to partially cure it and reshaping the laminate using a cool press forming tool, McKague is silent regarding the conditions both necessary for laminating the stack under heat and pressure to form a composite laminate, which is in direct distinction to the present claims which define a first process to heat a plurality of sheets made of fiber-reinforced composite at a defined temperature, under a defined pressure, and then cooling at a defined temperature and pressure to form a board-shaped laminate. These conditions are, of course, conditions necessary for softening the laminate (board) and forming the desired shaped semi-hardened product of the present invention without being curing (reshaping the laminate). In this regard, the present invention defines a third process step, which involves heating at a defined temperature for a defined time while placed on a forming tool and cooling at a defined temperature and a defined pressure.

Thus, in first process step (a) of the present invention, the sheets are preferably heated at 20 to 100°C under pressure using a hot press roll, a hot pressing machine, etc. When the heating temperature is greater than 100°C, the fluidity of the resin in the fiber-reinforced composite is excessively increased. On the other hand, when the heating temperature of less than 20°C, one can encounter insufficient stacking of the flat board-shaped laminate.

Further, the pressure is 0.1 to 10 kg/cm^2. A pressure of more than 10 kg/cm^2 results in disordered fiber orientation of the fiber-reinforced composite, and a pressure of less than 0.1

kg/cm^2 can lead to insufficient stacking of the flat board-shaped laminate (see page 4, line 24 to page 5, line 3 of the specification).

Further, in the first process step (a), the sheets are preferably cooled at 10 to 30°C under a pressure by a cold press roll, a cold pressing machine, etc. When the cooling temperature is more than 30°C, a sheet tends to be peeled off the flat board-shaped laminate whereas a cooling temperature of less than 10°C requires a great amount of energy for cooling. Further, the pressure is preferably 0.1 to 10 kg/cm^2. A pressure of more than 10 kg/cm^2 results in disordered fiber orientation of the fiber-reinforced composite, and a pressure of less than 0.1 kg/cm^2 can lead to insufficient stacking of the flat board-shaped laminate (see page 5, lines 4-11 of the specification).

In this regard, since McKague teaches that the McKague debulked laminate 34, be it uncured or only partially cured, can generally be stored at room temperature (McKague, column 6, lines 8-9 and Fig. 2), one might argue that the McKague debulked laminate 34 might possibly be kept in a low-humidity storage environment at room temperature, since this is certainly one of the almost limitless possibilities for storage. Even assuming that this is the case, McKague fails to teach the step of cooling the laminated sheets at 10 to 30°C under a pressure by a cold press roll, a cold pressing machine, etc., which would correspond to the cooling of the first process step (a) of claim 1 of the present application.

Further, in the third process step (c) of the claims herein, the board may be heated and softened by an oven, a heater, etc. The heating temperature is preferably 60 to 100°C, more

preferably 70 to 90°C. The board is heated preferably for 10 to 90 minutes, more preferably for 20 to 50 minutes (see page 5, lines 15-18 of the specification).

Still further, in third process step (c) of the claims herein, the softened board may be formed and cooled under pressure by a cold press roll, a cold pressing machine, etc. The cooling temperature is preferably 0 to 50°C, more preferably 20 to 40°C. When the cooling temperature is more than 50°C, the formed product returns into a board shape due to insufficient cooling. On the other hand, when the cooling temperature is less than 0°C, fluidity of the resin in the fiber-reinforced composite is reduced too much before forming, resulting in insufficient forming. Further, the pressure is preferably 0.1 to 10 kg/cm^2. A pressure of more than 10 kg/cm^2 results in disordered fiber orientation of the fiber-reinforced composite, and a pressure of less than 0.1 kg/cm^2 can lead to insufficient forming (see page 5, lines 15-28 of the specification).

Thus, since McKague is silent regarding the detailed conditions for forming a shaped semi-hardened product as called for in the claims of the present application, quite clearly one of ordinary skill in the art, referring to McKague, would not be motivated to reach amended claim 1. Accordingly, Applicants submit that amended claim 1 is not obvious over McKague.

Applicants appreciate, of course, the fact that the rejection is a combination rejection, and now turn to Hiyamizu. The Examiner has analyzed Hiyamizu in some detail in the instant Action, and Applicants will not repeat the Examiner's analysis of Hiyamizu except as appropriate to an understanding of Applicants' traversal regarding Hiyamizu.

Hiyamizu discloses a device for continuously producing a fiber-reinforced composite material comprising:

a plurality of prepreg winding rollers to wind and hold sheet-shaped prepregs fabricated through a prescribed process;

pressing rollers to laminate and press the prepreg supplied from the prepreg winding rollers, a plurality of pressing and heating rollers to convey the laminated and pressed prepreg supplied from the pressing rollers with pressing and heating thereof for curing; and

a prepreg curing device having a belt placed between the rollers to convey the prepreg supplied from the pressing rollers (see English translation of claim 1 of JP '518 attached hereto; hereafter often just "translation").

Hiyamizu thus teaches a device for continuously producing fiber-reinforced composite materials such as carbon fiber-reinforced plastics using sheet-shaped prepregs by laminating and pressing a plurality of prepregs at 100-160°C under 1-7 kg/cm^2, followed by curing (see translation of column 2, lines 1-10, and right upper column 16, lines 12-16). However, Hiyamizu is silent regarding a method for continuously producing an intermediate product made of a fiber-reinforced composite as a semi-hardened product having a limited hardening degree without curing as disclosed in the present invention (underscore added).

Specifically, in Hiyamizu the prepreg supplied from the prepreg winding rollers is heated to about 100°C, 133°C, 150°C and 160°C for curing at each pair of hot rollers (19, 19a; 20, 20a; 21, 21a; 22, 22a) located in a prepreg curing device (see translation, left upper column 15, line 14 to right upper column 16, line 6 of JP' 518 and Fig. 1). This is quite different from the present invention which heats at 20-100°C in process step (a) as when the heating temperature is

more than 100 °C, fluidity of the resin in the fiber-reinforced composite is excessively increased (see page 4, lines 25-27 of the present specification).

Further, Hiyamizu is silent regarding the cooling temperature after curing, though Hiyamizu teaches use of a cooling plate 29 (without pressure) after the prepreg curing device 18 (see translation, right upper column 16, lines 12-16 of JP '518 and Fig. 1). However, the cooling temperature in process step (a) of the present invention is set at 10-30°C, since a cooling temperature more than 30 °C makes a sheet tend to peel off the flat board-shaped laminate while a cooling temperature of less than 10 °C requires a great amount of energy for cooling (underscore added) (see page 5, lines 5-8 of the specification).

Accordingly, Applicants respectfully submit that one of ordinary skill in the art, even considering McKague and Hiyamizu together, would not be motivated to reach the invention as called for in amended claim 1 and, accordingly, amended claim 1 herein is not obvious over McKague in view of Hiyamizu.

The Examiner further, however, at page 4 of the Action, refers to Della Vecchia. In the first full paragraph on page 4 of the Action, the Examiner's remarks can be paraphrased as follows:

Della Vecchia is directed to:

a stampable fiber reinforced thermoplastic sheet; and

teaches a process for forming such a sheet comprising feeding layers of composite material to a laminating apparatus, laminating layers into a stampable sheet using heated press rolls (under pressure) followed by using cooling press rolls (under pressure) and cutting the

laminated layers into stampable sheets, further teaching a stamping process comprising heating the stampable sheet followed by press forming.

Applicants must agree that Della Vecchia teaches a process for producing a composite laminated sheet including the steps of:

(1) laminating sheets 13 and 15, each composed of a filled thermoplastic resin, and a thermoplastic sheet 20 with a long fiber mat or mats 23 to effect an impregnation of mat 23 by molten sheet 20 and lamination of the resulting product to sheets 13 and 25 at laminating rolls 21a and 2lb at a temperature 10-70°C below the polymer melting point under a pressure of 100-1,500 lb/linear inch to form a laminated sheet 25 (column 2, line 56 to column 3, line 34 and Fig. 1); and

(2) cooling the laminate 25 at cooling rolls 29a and 29b at a temperature capable of quickly lowering the temperature of the laminate 25 sufficient for easy cutting on cutter mechanism 26 (see column 3, lines 43-45, and Fig. 1).

However, these Della Vecchia conditions for laminating and cooling are quite different from those of the present invention as defined in first process step (a) where a plurality of sheets made of the fiber-reinforced composite are heated at a temperature of 20-100°C under 0.1 to 10 kg/cm^2, and cooled at a temperature of 10-30°C under 0.1 to 10 kg/cm^2. Moreover, Della Vecchia fails to teach or suggest a process for producing an intermediate product made of a fiber-reinforced composite as a semi-hardened product having limited hardening without curing as in the present invention (underscore added).

As a consequence, Applicants respectfully submit that one of ordinary skill in the art, referring to Della Vecchia, who teaches the use of cooling rolls, would not be lead to the present invention as recited in amended claim 1 and, accordingly, amended claim 1 is not obvious over Della Vecchia, even if combined with McKague and Hiyamizu.

Applicants now would like to briefly refer to new claim 4 which involves a T-shaped intermediate product composed of L-shaped board laminates, where the flat board-shaped laminates each comprise only one flat-shaped board laminate.

McKague teaches a cured T-shaped product, which is not formed from only one flat-shaped board laminate, since the method for fabricating a composite part per McKague does not include a cutting process step (b) as claimed in the present invention, rather, in McKague the product is formed from debulked laminate 82 and right angle pre-forms 86 each formed in tool 84 from another debulked laminate 82 prepared from laminate 76, which requires more steps of laminating and debulking, a process quite unfavorable in view of economic efficiency, since the number of the laminating processes is not decreased.

Turning now to claim 5 of the present application, which essentially is claim 2 rewritten in independent form with a 1-80% hardening degree limitation, while claim 5 does not contain the precise limits of amended claim 1 regarding pressure, temperature, etc., the following limit occurs at the end of claim 5:

wherein said intermediate product is a semi-hardened product having a hardening degree of 1 to 80 %, said fiber-reinforced composite being composed of a reinforcing fiber impregnated with a thermosetting resin."

Regarding original claim 2, at page 4 of the Action, the Examiner states as follows with respect to original claim 2:

> "Regarding claim 2, as noted above McKague et al. teach the intermediate part only partially cured, i.e. semi-hardened, such that the part can be used in further processing. Furthermore, one of ordinary skill in the art at the time the invention was made would have readily appreciated only partially hardening the part, e.g. to a degree of 1-50%, when using a thermosetting resin that is to undergo further processing, molding, other wise the part could not be processed further."

However, Applicants must disagree with the Examiner's position regarding original claim 2 and claims 5-7 for the following reasons.

Claim 5 deals for a method for producing an intermediate product made of a fiber-reinforced composite composed of a reinforcing fiber impregnated with a thermosetting resin or a thermoplastic resin which involves first step (a), second step (b) and third step (c), wherein the intermediate product is a semi-hardened product having the hardening degree above discussed.

Specifically, the final product of the present invention in the claim 5 is a semi-hardened product having a hardening degree of 1 to 80 % that can be easily handled and stored and that has properties suitable for integration with the skin (see page 4, lines 9-14 of the specification).

As earlier mentioned, in McKague, insofar as processing either in flow 24 of Fig. 2 or in flow 74 of Fig. 4 is concerned, partially cured laminate 34 or 82 is not provided automatically, and the pre-forms shown in McKague are merely intermediate parts (86, 86, 82) for forming a final shaped product (90), different from a semi-hardened product having a hardening degree of 1 to 80 % as a final shaped product formed after treatment of the laminated board under the conditions for softening and cooling as defined in third process step (c) of the present invention, about which McKague is silent.

As earlier mentioned, Hiyamizu and Della Vecchia are also silent regarding an intermediate product as a semi-hardened product having a hardening degree of 1 to 80%.

Accordingly, on this record, there is no teaching whatsoever in the prior art which would suggest an intermediate product as a semi-hardened product having a hardening degree of 1 to 80% as called for in claim 5 or suggest the narrow hardening degree of claims 6 and 7.

Accordingly, Applicants submit that claims 5-7 are not rendered obvious by the prior art relied upon.

Withdrawal of all rejections and allowance is requested.

Respectfully submitted,

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